Before the

Federal Communications Commission

Washington, DC 20554

In the Matter of	)	
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Carrier Current Systems, including Broadband over Power Line Systems	)	ET Docket No. 03-104
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	)	
Amendment of Part 15 regarding new requirements and measurement guidelines for Access Broadband over Power Line Systems	)	ET Docket No. 04-37

Comments of Aeronautical Radio, Inc.

Aeronautical Radio, Inc. ("ARINC") hereby submits its comments in response to the Commission's *Notice of Proposed Rule Making*[1] For the reasons set forth below, ARINC urges the Commission to proceed with caution in the authorization of access broadband over power line service ("Access BPL") so as not to endanger the functioning of the nation's high frequency communications service in support of aviation safety.

Background

ARINC is the communications company of the air transport industry, established in 1929, at the urging of the Federal Radio Commission to coordinate, manage, and conserve the limited radio spectrum available for aviation safety communications.[2] Today, ARINC continues to perform that role on behalf of the air transport industry, and in furtherance of its primary objective, ARINC holds more than 5,200 licenses from the Commission under Part 87 of the Rules to provide civil aviation with aeronautical enroute service throughout the United States and in the Flight Information Regions (FIRs) assigned to the United States by the International

[1] Notice of Proposed Rule Making, FCC 04-29, rel Feb. 23, 2004 ("*NPRM*").

[2] *See* Fourth Annual Report of the Federal Radio Commission to the Congress of the United States for the Fiscal Year 1930, at 69-70 (1930).

Civil Aviation Organization ("ICAO"). While the vast majority of these stations utlize VHF spectrum, high frequency (HF) stations operating in the 3 to 30 MHz region continue to play a critically important role in furthering the safe and efficient operation of aircraft in oceanic and other remote regions beyond the range of VHF communications. ARINC provides service to all segments of civil aviation, including foreign aircraft operators and general and business aviation. ARINC's HF network handles more than 210,000 voice and 450,000 data messages per month in support of aviation.

In the HF spectrum the ARINC Air/Ground International Radio Service provides high frequency single side band aeronautical operational control (AOC) voice and data communications[3] for aircraft flying over the Atlantic, Caribbean, and Pacific oceans; Canadian and Arctic regions; and the Gulf of Mexico and Central and South America. ARINC's HF long distance operational control (LDOC) facilities provide worldwide coverage. ARINC connects the far-reaching corners of the world to one of two ARINC Communications Centers located in New York and San Francisco. The ARINC Communication Centers also relay air traffic control (ATC) flight movement messages for the FAA while aircraft are flying in the FIRs assigned to the FAA.[4] The radio operators at these facilities also control remote, high-powered HF radio sites located in Molokai, Hawaii; Guam; Barrow, Alaska; Long Island, New York, and the San

[3] This service is used to coordinate ground and flight activities, inform aircraft dispatchers of important events including in-flight emergencies, address irregular operations such as delays and the need for more fuel due to weather conditions, make ground arrangements for the servicing of aircraft, divert aircraft, and provide timely position reports for flight following. U.S. air carriers are required to have access to AOC throughout the world by 14 C.F.R. § 121.95. Both aeronautical operational control and air traffic control are safety services and are entitled to special measures to avoid interference under the International Radio Regulations. See RR 1.33, 1.59, and 4.10.

[4] The vast majority of the voice messages are FAA ATC, flight following, and way-point reporting; about 10,000 are LDOC.

Francisco Bay area in California. Other ARINC licensed HF facilities are operated in Miami, Florida; Houston, Texas; and Cedar Rapids, Iowa, in support of AOC operations.[5]

ARINC mentioned in earlier Reply Comments the fickle nature of the HF communications medium in its sensitivity to noise levels.[6] The ambient noise level at the receiver largely determines whether an aircraft can communicate. Any FCC action that would result in an increase in the noise floor in the HF radio spectrum utilized for aviation communications would inevitably diminish the ability of aviation to maintain communications with aircraft operating over oceans and in the remote areas of the world. This loss of communication would directly impair safety of life and property in the air.

The Standard for BPL Emissions

The overarching concern that the aviation community faces with BPL is that power lines will act as antennas and radiate energy from BPL transmissions in a manner that could interfere with HF aeronautical communications. The Commission wisely reached tentative decisions not to increase the level of permissible radiation from power lines carrying BPL signals and to require BPL systems to operate under the cardinal conditions of Part 15: (1) not to cause harmful interference and (2) to accept interference from licensed radio stations and other unlicensed devices, including interference that may cause undesired operations.[7] Thus, the

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[5] These facilities are staffed by Silvair, Universal Aviation Weather, and Collins Radio, respectively, and provide additional support to aviation in areas beyond the reach of VHF service.

[6] ARINC Reply Comments, ET Docket No. 03-104, at 3 (Aug. 20, 2003).

[7] BPL would be subject to these conditions under Section 15.5 of the Rules, 47 C.F.R. § 15.5 (2003). In the case of the fixed installations employed by ARINC in support of both ATC and AOC communications, reception of signals at a level of –135 dBW in a 2.4 kHz bandwidth should be maintained. Although at the noise floor, ARINC radio operators are trained to communicate with aircraft whose signals are received at this level. Because the radio operators must often "pull signals out of the noise," ATC communications are normally relayed to the FAA in record form.

Commission recognized that BPL systems must not cause harmful interference and could be subject to interruptions and performance degradation caused by the transmissions of licensed HF stations being picked up by power lines.

Maintenance of the 30 uV/m at 30 meters signal level within the HF bands, however, is no guarantee that harmful interference to aeronautical communications will not result from BPL signals. Accordingly, ARINC supports the Commission's proposal to require that Access BPL systems be constructed using equipment that features interference mitigation capabilities.[8] The rules should mandate that such equipment include the remote capability to change the frequencies used by Access BPL devices including the ability to notch out remotely certain frequencies, to reduce the power of the signal injected into power lines, and, if necessary, to shut down BPL circuits until interference can be resolved. These capabilities should not merely be examples of features that *could* be included. The rules should mandate their inclusion as well as the maintenance and regular testing of this capability..

Obviously, BPL transmissions should not be allowed to cause groundwave or conducted interference to aeronautical HF communications. HF, however, presents an additional interference concern. Because HF signals are characterized by long distance skywave propagation that can produce interference for hundreds of miles with radiated signals of less than a watt, the Commission should require that Access BPL devices and carrier current in-home BPL equipment not operate on the Aeronautical Mobile (R) frequencies unless and until actual operating experience with BPL systems has shown conclusively that skywave propagation will not occur.[9] These are the aeronautical mobile "enroute" frequencies that are used for the

[8] NPRM, ¶¶ 40 – 42, App. A (proposed rule § 15.109(f).

[9] These frequencies include: 3000-3025, 3400-3500, 4650-4700, 5450-5680, 6525-6685, 8815-8965, 10005-10100, 11275-11400, 13260-13360, 17900-17970, and 21924-22000 kHz. The same frequencies must be protected from groundwave and conducted interference. Accordingly,

transmission of messages involving both air traffic control and aeronautical operational control. As safety services, protection of each of these is essential to the safe and efficient operation of both air-transport and general aviation aircraft. If proof that skywave propagation poses no interference threat to aviation is forthcoming within the next few years, the Commission should issue a further notice of proposed rule making examining such evidence before moving forward with any changes in the rules that would involve operations on the Aeronautical Mobile (R) frequencies.[10] Similarly, the Commission should not authorize any BPL operations in the band 74.8 – 75.2 MHz, which is used for outer marker beacons employed in instrument landing systems.

Providing protection of this sort to the Aeronautical Mobile (R) frequencies and the 74.8 – 75.2 MHz band would be very much in keeping with prior Commission actions. Thus, the Commission requires cable television systems to perform annual measurements of signal leakage as a condition of allowing the use of VHF and UHF aeronautical spectrum by the system.[11] Indeed, these yearly measurements contrast with the equipment authorization approach proposed

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even if the Commission is able eventually to determine conclusively that skywave propagation from BPL systems poses no threat of harmful interference either to aircraft or land stations serving aviation, the Commission's procedures for the implementation of Access BPL must provide a high measure of assurance that interference from groundwave and/or conducted BPL signals will not occur. The coordination and prior testing requirements proposed herein for any BPL operations in the vicinity of the ground receiving sites for ARINC's long distance HF stations are steps that should be employed before operations on any HF frequencies are commenced or changed in the vicinity of such receiving sites.

[10] ARINC notes that NTIA has stated that it intends to conduct a review of the possibility of skywave interference to aeronautical and other critical HF services in phase 2 of its review of BPL. While the Commission should certainly consider this future study, only operational experience coupled with sound theoretical analysis should provide the basis for consideration of BPL operation within the aeronautical mobile (R) frequencies. NTIA singled out the Aeronautical Mobile (R) frequencies for special consideration with respect to BPL operation. NTIA Report 04-413, Potential Interference From Broadband Over Power Line (BPL) Systems to Federal Government Radiocommunications at 1.7 – 80 MHz, § 4.6. Unless and until the Commission can be sure that harmful interference will not result, BPL operations should not be allowed on these frequencies.

[11] 47 C.F.R. § 76.611 (2003).

in the *NPRM*. Even carrier current campus systems operating in the AM broadcast band are subject to a requirement that each such system be the subject of measurements to determine that it complies with the Commission's requirements.[12] The Commission would authorize access BPL equipment on the basis of measurements made in three systems. Individual BPL systems implemented thereafter using the equipment would not be required to undergo any measurements as a condition of operation. Instead, the Access BPL system operator would be required to file certain details pertaining to the system's configuration with an industry sponsored entity. The *NPRM*, however, fails to make ready provision for licensees of safety services to gain immediate access to such information. Not only should the Commission require that Access BPL providers implement a process whereby safety service licensees have access to this information 24 hours a day, seven days a week, the Access PBL providers should be required to make provisions for a supervisor to be contacted on a 24/7 basis in the event that immediate action is required to mitigate interference.

ARINC also urges the Commission to require Access BPL operators to coordinate with ARINC before commencing operations within fifteen miles of the fixed ARINC receive sites.[13] Currently, there are eight such sites. Most of these are in remote areas. ARINC will cooperate with Access BPL providers in conducting tests in advance of BPL operations in order to verify that no interference is likely to occur to the ARINC receivers.[14] Because the ARINC receive

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[12] 47 C.F.R. § 15.221 (2003). In addition, the rules provide that "…the frequency of operation shall be chosen such that operation is not within the protected field strength contours of licensed AM stations." *Id*. at (d).

[13] Access BPL operators should also note the locations of ARINC HF transmit sites in order to avoid the possibility of interference to Access BPL systems. ARINC's main transmitter sites employ up to 5,000 watts of output power.

[14] Because of the potential for adjacent channel interference and intermodulation interference, testing of this nature should be required even if the Commission follows through with ARINC's proposal that the Aeronautical Mobile (R) frequencies not be utilized for BPL unless and until the Commission has the benefit of both actual operational experience and sound theoretical

sites are typically not co-located with the ARINC HF transmitting sites, ARINC will provide precise location information to individual BPL providers and to the industry entity that the providers would create to store data on Access BPL operations.

Measurement Issues

The Commission recognizes in the *NPRM* that BPL systems, particularly Access BPL systems, pose special challenges in making reliable measurements of radiation. Contrary to the implication of the proposal to measure only three systems for purposes of equipment authorization verification and then not to require that individual systems be measured, ARINC submits that with Access BPL there will be such diversity in the topology and operation of Access BPL systems that each will be unique, just as campus carrier current systems and cable television systems are unique. For this reason, the Commission should not simply rely on equipment authorization testing to ensure that all Access BPL systems meet the field strength limits set forth in set forth in Section 15.109, including the limit of 30 uV/m at 30 meters for HF spectrum.[15]

ARINC also questions certain of the underlying assumptions set forth in the Commission's measurement proposals. With respect to actual measurements, the *NPRM* focuses on radiation from injection sites and devices used to pass BPL signals around transformers.[16] While any measurement program must take into account signals from such sites, the ability of power lines carrying RF to act as antennas and radiate the RF must also be addressed. The

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studies that demonstrate conclusively that skywave interference from BPL radiation will not cause interference to aeronautical communications.

[15] The HF limits are set forth in Section 15.209(a) and incorporated by reference in Section 15.109(e).

[16] NPRM, ¶ 36. Equipment to pass BPL signals around transformers is required because the transformers are designed to handle 60 Hz AC power, but are very inefficient at RF frequencies and, thus, greatly attenuate or block the Access BPL signals.

Commission has attempted to do so by recognizing that additional measurements along a power line may be required in certain circumstances.[17] In analyzing the characteristics of power lines carrying HF RF signals, ARINC engineers have conducted simulations using Numerical Electromagnetics Code NEC-4 Method of Moments software.[18] These simulations revealed that power lines exhibit lobes at various frequencies in the HF band and that, depending on frequency, line spacing, injection mode and impedance characteristics, these lobes can have positive gain with respect to an isotropic radiator. These lobes are located away from Access BPL devices. As such, power lines definitely exhibit characteristics that are much like those of other antennas, albeit with great variation due to the large number of possible configurations within any Access BPL system. These radiating lobes render inadequate any measurement program that relies solely on data taken at the site of BPL devices to determine compliance. Moreover, nearly any radiated measurement of the BPL signals radiated from a power line will be made in the near field and subject to further inaccuracies associated with making measurements at less than a wavelength from the emitting source. This, too, underscores the inadequacy of simply relying on tests of three Access BPL systems as being representative of all such systems. Finally, ARINC's simulations revealed that the signal radiated from power lines cannot be expected to fall off at 40 dB/decade as contemplated in the Commission's Rules.[19] Instead, 20 dB/decade far better characterizes the fall off that should be expected generally within the HF band insofar as the attenuation of signals from power lines is concerned.

Within the last week, ARINC engineers returned to Half Moon Bay, California, to remeasure noise at this key receiving site used as part of the HF network in support of ATC and

[17] NPRM, ¶ *45;* App. C, Sec. 2(b)(2).

[18] ARINC looks forward to providing details of this simulation in future submittals.

[19] 47 C.F.R. § 15.31 (2003); NPRM, n. 104.

AOC communications. This time, ARINC employed calibrated measurement instruments instead of the diagnostic equipment that had formed the basis for the findings reported in ARINC's Reply Comments submitted in response to the Notice of Inquiry in ET Docket No. 03-104. During these measurements, the manmade noise being received at the site's omnidirectional antenna was –80 dBm (-110 dBW) to –96 dBm (-126 dBW), essentially the same level of interference reported earlier. The noise appeared similar in nature to noise that ARINC has seen before from laboratory tests on carrier current in-house BPL systems and caused debilitating harmful interference at 3013 kHz. ARINC anticipates supplementing the record in this proceeding with details of the latest measurements at Half Moon Bay. As such, ARINC reiterates the necessity for protecting its critical HF receive sites from interference and the need for coordination and testing before additional sources of noise are implemented near such sites.

Conclusion

Access BPL may provide yet another path for broadband communications in addition to DSL, cable modem, and various wireless services. The implementation of Access BPL need not and must not compromise essential HF safety services. ARINC stands ready to work with Access BPL providers and the Commission in striving to ensure that the use of power lines for the transmission of RF communications signals does not compromise aviation safety. Accordingly, any rule revisions made to implement Access BPL should (1) not increase the signal levels beyond those set forth in Sections 15.109 and 15.209 of the Commission's Rules; (2) require operation in accordance with the conditions of Section 15.5 of the Rules; (3) mandate the inclusion, maintenance and testing of interference mitigation techniques; (4) require coordination and testing of Access BPL operations with ARINC prior to implementation of service to the public; (5) avoid the use of Aeronautical Mobile (R) spectrum for Access BPL

unless and until both theoretical analysis and actual operational experience show conclusively that there is no likelihood of skywave propagation; and (6) require that each Access BPL system be evaluated to determine compliance with the Commission's Rules governing operation of Access BPL systems. By taking these steps, the Commission will help to ensure that this new path to the internet will not also endanger the safety of aeronautical communications and those who depend on such communications for the safe and efficient operation of aircraft.

Respectfully submitted,

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